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[54] **CODE DIVISION MULTIPLEXER USING DIRECT SEQUENCE SPREAD SPECTRUM SIGNAL PROCESSING**

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[58] **Field of Search** 375/1.0, 2.1, 2.2, 115, 375/22; 364/724; 370/18, 19

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,701,894	10/1972	Low et al.	235/181
4,048,563	9/1977	Osborne	375/1.0
4,164,628	8/1979	Ward et al.	375/1.0
4,178,549	12/1979	Ledenbach et al.	375/22
4,241,447	12/1980	Epstein	375/1.0
4,247,939	1/1981	Stromswold et al.	375/1.0
4,286,333	8/1981	Franklin	375/1.0
4,361,891	11/1982	Lobenstein et al.	375/115
4,460,992	7/1984	Gutleber	370/19
4,493,080	1/1985	Campbell	364/724

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[57] **ABSTRACT**

A plurality of transmitters synchronized to a common clock each transmit a data signal spread by a common bipolar pseudo-random code having a different predetermined assigned code sequence shift. A receiver, synchronized to the clock, discriminates the signal transmitted by a predetermined transmitter from signals transmitted by the others by generating a first bipolar pseudo-random code that is a replica of the common bipolar pseudo-radom code and has a code sequence shift corresponding to that of the predetermined transmitter, and a second bipolar pseudo-random code and has an unassigned code sequence shift. The difference between the first and second bipolar pseudo-random code sequences, which is a trinary code sequence, is cross-correlated with the incoming signals. The cross-correlation despreads only the signal applied by the sequence having the predetermined code sequence shift. Each receiver includes a number of correlation detectors offset from each other by a fraction of a code chip together with decision circuitry to identify cross-correlation peaks for optimum synchronization.

8 Claims, 38 Drawing Figures